

cient to raise the relative humidity to anything like that prevailing outdoors, owing to the annoying condensation on the windows or colder walls. In the experiments made at Topeka, Kans. (previously discussed) humidity observations were made also in living rooms in various parts of the city. It was found that when the indoor humidity was raised as high as 50 per cent in cold weather, the windows and even painted walls of the rooms were usually dripping with moisture. What would be the physical effect on passing from a room of this character into a piercing winter wind?

DISCUSSION BY AUTHOR.

Mr. Kincer's review brings up several points of much importance. For example, he points out that if the article in *Ecology* is correct, there "should be a marked contrast in the death rate between those sections of the country having humid climates and those characterized by dryness of the atmosphere, the comparison being to the disadvantage of the drier climates." This conclusion seems justified; it can not easily be tested, however, for many other factors, such as the degree of outdoor life, the relative ages of the population, the size of the cities, and the amount of manufacturing and other unhealthful occupations must be taken into account. Nevertheless, the statistics of three life insurance companies, which I have published in *Civilization and Climate*, page 184, show that when similar groups of "risks" are compared the death rate in the dry parts of the United States is decidedly higher than in the moister regions. Again, as I have shown in an article to be published shortly in the *Geographical Review*, the cities in dry regions—for example, Cairo, Mexico City, Madrid, and the cities of northern India—have much higher death rates than the corresponding cities in moister climates where the degree of progress is similar.

Another point raised by Mr. Kincer is the importance of the period preceding death and especially of the day when an illness is contracted. I agree with him entirely. He seems, however, to have overlooked the fact that I make comparisons between the death rate and the day when influenza was contracted in New York City. Furthermore, in a study of operations published in *The Modern Hospital*, Vol. XIV, No. 1,¹ I have shown that the climatic conditions, especially the humidity, on the day when operations are performed is much more important than on the day of death. I should have gone into the matter much more fully were it not that in the nature of things it is very difficult to determine just when a disease was contracted. The important point is that wherever it has been possible to examine the matter thoroughly, both the day of death and the day when a given ailment was contracted appear to show a close relationship to the weather. Presumably, the relationship is strongest on the most critical day of the disease, no matter when that may come. In this connection it may be noted that a study of millions of deaths described in *World Power and Evolution*, and in *Modern Medicine*, vol. 1, No. 1, shows that when the month is taken as a unit, the general relation between health and the climatic elements is the same as when the day is the unit. For example, except at high temperatures, the moister months regularly show a lower death rate than the drier months. This has nothing to do with the seasons, for it appears when a single month, such as January, is taken for a series of years.

Still a third point is that if low temperature is the cause of deaths in winter, "we should have a progressive decrease in deaths from northern to southern limits of the country with the greatest number in the north central border States." This conclusion would be justified were it not that a study of some 9,000,000 deaths in France, Italy, and the United States shows that the human frame is much more sensitive in climates where there is little variation than in more rigorous climates. Hence the people in south Italy and New Orleans, for example, suffer severely in health under conditions of low temperature which would seem very mild and would do almost no harm to residents of the mountains of northern Italy or of Dakota.

In another place Mr. Kincer says that if a high temperature, such as an average of 75° within doors, is harmful, "we should expect to find the seasonal death rate reversed in northern and southern localities, Chicago and New Orleans, for example." That is, the highest death rate should come in Chicago in winter and in New Orleans in summer. This conclusion is not justified by the facts, for in both places the death rate from December to March is roughly 20 per cent greater than from June to September. Nor is it justified by anything that I have said. Whenever the average temperature departs far from 64° in either direction the death rate soon begins to show an upward tendency. People can do much to protect themselves, however, not only by regulating the temperature of dwellings, but by changing their mode of life, and by going out into the country and living out of doors in summer. In Chicago the great mass of ordinary people devote vastly more effort and expense to keeping warm in winter than to keeping cool in summer. In New Orleans the reverse is the case, in spite of the fact that the inhabitants are more sensitive to cold than are those of Chicago. Moreover, the Negroes who form so large a part of the population of New Orleans, not only are better adapted to hot weather than is the white man, but they flock cityward in winter, thus raising the death rate. In order to obtain a true comparison it is necessary to take cities of similar size, similar occupations, and as far as possible, of similar racial compositions. Moreover, the northern city should be far enough north to be largely free from the injurious effect of summer heat. No pair of cities satisfies these conditions, but a comparison of Minneapolis with Atlanta and Birmingham may be instructive. The following table shows the average number of deaths per day by months from 1913 to 1917. The northern city shows a maximum in January, while both of the others have theirs in June when the first heat of summer sweeps away a great many of the weaker parts of the community. This reversal between the north and the south agrees with the conclusions drawn from millions of deaths in a score of countries.

Deaths per day, 1913-1917.²

	Minneapolis.	Atlanta and Birmingham.		Minneapolis.	Atlanta and Birmingham.
January.....	133.9	151.3	July.....	104.4	171.8
February.....	126.0	173.5	August.....	98.9	154.0
March.....	128.2	173.3	September.....	102.7	146.7
April.....	125.0	158.2	October.....	102.9	143.6
May.....	120.7	171.3	November.....	109.7	157.8
June.....	101.4	188.5	December.....	123.0	162.0

² It is noted that July and August are the hottest months in Atlanta and Birmingham, both considerably warmer than June, yet in August the tabulation shows a death rate of 8 below the average for the year.—J. B. K.

¹ Reviewed in MONTHLY WEATHER REVIEW, May, 1920, 48: 279-280.

Perhaps the most important feature of Mr. Kincer's paper is an attempt to show statistically the lack of relationship between outdoor conditions and the temperature and humidity within doors. I agree with him entirely that this is one of the points where further study is most needed. The only thing that has prevented a far fuller study of the matter is the absence of records and the lack of funds for carrying on observations. It would be most valuable if the Weather Bureau could keep thorough records of temperature, humidity, and variability in hospitals, offices, and other inhabited buildings, and make careful comparisons between these and the outdoor conditions. If Mr. Kincer's suggestion lead to this result, they may prove of great value.

In the present case Mr. Kincer uses two small series of observations—one, by Prof. Ward, including 20 days, and the other, by Mr. Flora, including 32 days as originally published. Both periods are too short to give final results. Mr. Flora's data, however, include 89 observations, for on most days he took records at morning, noon, and night. These give preliminary answers to two questions raised by Mr. Kincer: First, Is there a definite relationship between the amount of water vapor in the outside air and in the inside air in winter? Second, When the temperature out of doors rises in winter, is there a tendency toward unduly high temperature within doors? In discussing the first question, Mr. Kincer uses relative humidity as if it were an absolute quantity. It scarcely need be said, however, that relative humidity means nothing unless the temperature is also stated. Foreign students have sometimes criticized Americans severely for the importance which we apparently attach to relative humidity. We seem to them to make the tacit assumption that a relative humidity of 70 per cent, for example, at a temperature of 60° F. is comparable to a similar relative humidity at 10° F. In the first case, however, a cubic foot of air contains nearly eight times as much water vapor as in the second. While I have attempted always to state the temperature as well as the relative humidity, I realize that it would have been better to use the vapor content of the atmosphere. I am glad that Mr. Kincer's suggestions once more call attention to the matter, for we need a complete change of attitude.

If the data given by Mr. Flora and quoted by Mr. Kincer are analyzed in respect to the vapor content of the atmosphere, a close relation between the amount of vapor in the outside air and within doors is at once apparent. This is shown by the following table:

Grains of vapor per cubic foot of outside air.	Number of cases.	Grains of vapor per cubic foot of inside air.
0.00 to 0.50	6	1.39
0.51 to 1.00	12	1.64
0.01 to 1.50	21	2.05
1.51 to 2.00	17	2.22
2.01 to 2.50	8	2.62
2.51 to 3.00	6	3.00
3.01 to 3.50	7	3.24
3.51 to 4.50	7	3.73
Over 4.50	5	4.83

The first column shows the number of grains of water vapor in a cubic foot of the outside air as deduced from Mr. Flora's table. The next shows the number of observations, while the third gives the average number of grains of moisture per cubic foot in the inside air. The vapor content of the inside air increases with almost perfect regularity in harmony with the increase of the vapor content of the outside air. There can be little

question that during the period of Mr. Flora's observations the amount of vapor within doors was a direct function of the amount out of doors.³

In respect to the second question, confusion has arisen between the effect of a moderately high temperature in winter when it lasts for some days and the effect of a rise of temperature. In the article in *Ecology*, which is reviewed by Mr. Kincer, and in various other places, I have endeavored to make it clear that these two conditions must be sharply distinguished. A relatively high outdoor temperature in winter in the northern United States is favorable unless the houses are kept too warm or unless people expose themselves unwisely. On the other hand, the rise from a low temperature to a moderate temperature is almost always accompanied by an increase in the death rate, as I have shown in *World Power and Evolution*, where 400,000 deaths in New York City have been studied in relation to the daily changes of temperature during a period of eight years. Mr. Kincer, if I understand him correctly, maintains that Flora's figures show no relation between inside temperature and the rise in the outside temperature. In order to test this I have taken Flora's data and have compared the indoor temperature with the changes in the outdoor temperature during the preceding 24 hours. The results appear below.

Change in outside temperature in 24 hours.	Number of cases.	Average inside temperature.
Drop of over 10°	14	71.4
Drop of 4°-9°	10	73.2
Change of 3° or less	18	73.0
Rise of 4°-9°	22	73.9
Rise of over 10°	13	73.9

The first column shows the amount of change in temperature during 24 hours. The second shows the number of cases, and the third the average temperature indoors. While these figures are not quite so regular as the preceding set, it is clear that there is a fairly systematic rise from an inside temperature of 71.4° following a drop of 10° or more to an inside temperature of 73.9° when the temperature rose 10° or more. The work of the New York City Ventilation Commission shows conclusively that such a difference of 2.5° produces a strain upon the heart and hence upon the whole system. Thus, in this case as in the other, Mr. Kincer's attempt to apply a test by means of exact records furnishes valuable evidence in support of the conclusions reached in the article in *Ecology*.⁴

In regard to mental tests in the schools of New York City, I have elsewhere (*World Power and Evolution*) shown that various factors aside from humidity are concerned. A reexamination of this experiment which will shortly be published, indicates that judged by the effect of temperature upon patients undergoing operations in hospitals, the total effect on health produced by the slight humidification of the rooms in the New York schools can scarcely be expected to have exceeded 1 or 2 per cent. This small figure arises from the fact that the humidification raised the relative humidity only

³ No question was raised as to the comparability of the outdoor and indoor absolute humidity, as it was realized that there must necessarily be a close relation in these so long as no additional moisture was added to the indoor air. Prof. Huntington, however, used relative humidity and not absolute humidity in his investigation, and these values were under discussion.—J. B. K.

⁴ The question more particularly raised in this connection was the justification for the refinement of the tabulation of outside temperature data to which Prof. Huntington carried his comparisons. Eight divisions of temperature were made, mostly of 10° intervals. In the tabulation of indoor values here given, however, the absolute range, omitting the first case, is little more than half of a degree.—J. B. K.

from 29 per cent to 42 per cent, the mean temperature being 67°. Both of these degrees of humidity are much too low according to the results obtained from a study of pneumonia, operations, and deaths in general. Furthermore the children were subjected to the slightly humidified air only about 24 hours per week, while during the other 144 they lived under the same conditions as did the children who were in the drier room. A difference of 1 or 2 per cent in health could scarcely be expected to be evident in mental achievement, especially in view of the fact that the gradings depended upon only a single examination. One child with a cold would be enough to upset the entire result.

The question of the practicability of humification is of great importance. In many places it is to-day impracticable to have the degree of humidity which would seem to be desirable. That, however, is no reason for giving up the attempt. If we need greater humidity within our houses for the sake of health, the thing to do is to devise new methods of obtaining it. Double windows, for example, make a great difference in this respect; so, too, do proper air spaces within walls. In conclusion, a word should be said about the physiological effect of going from a warm room with fairly high humidity to the cold outside air in winter. I, too, like Mr. Kincer, supposed at one time that this was injurious. In order to test the matter, however, I made inquiries among greenhouse men who, more than almost any others, are subject to such changes. To my surprise I was repeatedly met by the most positive statement that greenhouse men feel no ill effects from going from the warm, moist greenhouse air to the cold air outdoors, especially when the greenhouses are kept near the ideal temperature, say at 65°. This point, like many of those discussed here, opens another great field where our knowledge is slight and where much further study is needed.—E. H.

RELATIONS BETWEEN THE METEOROLOGICAL ELEMENTS AND THE NUMBER OF DEATHS FROM INFLAMMATORY DISEASES OF THE RESPIRATORY ORGANS, AT PARIS.

By LOUIS BESSON.

[Abstracted from *Comptes Rendus* (Paris Acad.), Oct. 11, 1920, pp. 686-688.]

Having drawn upon the *Bulletin hebdomadaire de statistique municipale* for figures regarding the number of deaths from diseases of the respiratory organs, the author has studied them in relation to the daily and weekly means of the principal meteorological elements as determined at the Montsouris Observatory. The diseases considered were acute bronchitis, chronic bronchitis, pneumonia, broncho-pneumonia, pulmonary congestion, and other affections of the respiratory apparatus, with the exception of phthisis. The record covers the 10 years 1904-1913, or 522 weeks.

Evaluating the population of Paris at 2,784,000 during the period in question, he finds that there was a weekly average of 142 deaths from these causes, but there is a marked annual variation. There is a maximum in the middle of February and a minimum at the beginning of September. There is a secondary maximum in the middle of April and a secondary minimum in the middle of March. There is a marked relation between the antepenultimate weekly mean of temperature and these deaths, the one curve being the inverse of the other. There is also a direct relation between the number of days of the week preceding the death upon which there were winds from the NNE. to E. and the deaths. Considering

these two factors of temperature and wind direction, it is possible to eliminate their effects and determine a seasonal curve. When this is done, it is found that the first six months of the year have more deaths than the last, and that November is the most favorable, whereas January and April are the most unfavorable.

Humidity is only a secondary factor to these three, because it is dependent upon the direction of the wind. NNE. to E. winds are dry winds, and since there is an increase in the number of deaths following these winds, it may be said that the dry air is not favorable, a fact which does not justify the good reputation, as the author says, of the *petit froid sec*.¹

The details of the study, of which this note is a summary, will be published later elsewhere.—C. L. M.

COLDS AND THEIR RELATION TO THE PHYSICS OF THE ATMOSPHERE.

By C. M. RICHTER, M. D.

[Author's conclusions reprinted from the *Medical Record*, New York, Dec. 6, 1913.

1. Acute coryza, commonly called a "cold," depends for its development primarily on an excess of moisture in the air we inhale.

2. It develops, therefore, principally during the cyclonic weather condition called a LOW, especially when a period of very dry weather has preceded a LOW and when, in consequence, the change from previous dry air to the incoming very moist air is most rapid.

3. The excessive and more or less continuous nasal secretion at the beginning of an acute coryza relieves the respiratory apparatus from the otherwise damaging effect of an overcharge of moisture.

4. A child's nasal mucosa and the hyperesthetic one are especially prone to suffer.

5. The "running of the nose" constitutes in part a physiological vasomotor action analogous to the profuse and more or less continuous perspiration of the outer skin, which sets in whenever air temperature and relative humidity transgresses certain limits and which forces thereby better conditions for evaporation.

6. Latent microbism becomes active on the mucosa only after these air conditions have favored its development for some time. Microbism is very rarely the primary cause of an acute coryza.

NOTE ON TWO EARLY PAPERS ON THE PATHOLOGICAL ASPECTS OF CLIMATE.

Dr. I. M. Cline, who was for over ten years professor of climatology in the University of Texas and connected during that time with the United States Weather Bureau, and now in charge of the United States Weather Bureau station in New Orleans, La., made two contributions to the climatology of Texas based on over twenty years' records of Galveston, Houston, and other places.* These papers were read before the Texas State Medical Association in 1895 and 1896 and were entitled "The Climatic Causation of Disease with a Chart Showing the Pathological Distribution of Climate in the United

¹ M. Th. Tommasina (*Comptes Rendus*, Nov. 8, 1920, p. 939-949) takes exception to the author's conclusion, which, he says, is based upon a statistical study which was not adequate, owing to the peculiarities of diseases of the respiratory organs.

*In "The Monthly Bulletin of the Texas Weather Service," November, 1890, to October, 1891, Dr. Cline published studies on the comparison of daily mean temperature change, and departures from normal with the daily mortality from several diseases in Galveston, Tex. His data covered the years 1875-1889, inclusive. Similar studies, Dr. Cline believes, should be made in various parts of the country, thus affording a medical climatological survey which would be of great assistance to the physician in selecting the proper climate for his patient.—EDITOR.